M6 - ADVANCED TECHNIQUES OF IMAGE ANALYSIS

STUDY PLAN

Coordinated by

Dr Anna Planas  IIBB-CSIC-IDIBAPS Researcher at the team Brain ischemia: Clinical and experimental studies

GENERAL INFORMATION

Subject Name: Advanced techniques of image analysis
Code: 566667
Type: Optional
Teaching: Second semester
Coordinator: Dr. Anna Planas
ECTS credits: 3

OBJECTIVES

The purpose of this module is to provide students scientific, conceptual, methodological and practical knowledge on biomedical imaging. Students must acquire basic knowledge of a wide range of different imaging modalities applicable in humans and experimental animals. They will be guided by expert teachers from different technologies, acquiring basic knowledge about image analysis. The overall objective of this module spans from imaging techniques including biological samples for use in microscopy (optical, fluorescence, confocal, and electronics) and flow cytometry, to imaging in vivo including different types of MRI, nuclear medicine techniques (PET and SPECT), optical imaging, fluorescence, chemiluminescence and laser. These techniques will show students the different available tools for biological image, from structure to molecular imaging.

PRE-SKILLS AND REQUIREMENTS

General

G1: Understand, interpret and discuss issues with clinicians
G2: Become familiar with the progress of research in bioimaging and learn the tools necessary to access the continuous training
G3: Read, understand and discuss scientific texts
G4: Use of spoken and written English

Specific

S1: Understand the major diagnostic and therapeutic imaging techniques
S2: Know the latest imaging technology techniques and applications for clinical and basic research as their advantages and limitations
S3: Distinguish, use and analyze various microscopy and biomedical imaging techniques
S4: Gain knowledge on processing, quantification and optimization of various types of biomedical images
S5: Visit different experimental units: confocal microscopy, electron microscopy, flow cytometry, high magnetic field MRI
1. Introduction to Imaging Techniques and Analyses
2. Microscopy
   2.1 Optical - Basic histology, advanced techniques for immunohistochemistry and immunocytochemistry
   2.2 Optical imaging in living animals and humans: laser technology
   2.3 Intravital
   2.4 Confocal
   2.5 Electronic
   2.6 Microscopic analysis of living cells
   2.7 Microscopy image processing, optimization, and quantification
3. Flow Cytometry: technical description and applications
4. Autoradiography
5. Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT)
6. Magnetic Resonance Imaging (MRI)

METHODOLOGY

Total training hours: 3 credits ECTS x 25h/credit = 75h

a) Face-to-face training (32h):
   - Lectures
   - Seminars

b) Home training (43h):
   - Individual and group work

EVALUATION

Evaluation criteria: Attendance and active participation in classes (especially in Seminars) will be worth 50% of the final mark, the remaining 50% will depend on the presentation of a written report whose details will be announced on the first day of class.

Examination reviews: The grades will be announced at the appropriate section of the Virtual Space.

REFERENCES

Books
- Gonzalez, Woods, Digital image processing. Addison-Wesley
Publications


Links

- http://www.bdbiosciences.com/
- http://www.leica-microsystems.com/
- http://health.siemens.com/
- http://www.microscopyu.com/articles/fluorescence
- http://www.med.harvard.edu/aanlib/home.html
- http://www.cis.rit.edu/htbooks/mri/
- http://www.humanconnectomeproject.org

Software

- Image Processing and Analysis in Java (http://imagej.nih.gov/ij/)
- FMRIB Software Library v5.0 (http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/)
- Statistical Parametric Mapping (http://www.fil.ion.ucl.ac.uk/spm/)
- AFNI (http://afni.nimh.nih.gov/afni)
- The Brain Imaging Software Toolbox (http://www.bic.mni.mcgill.ca/software/)
- Talairach software (http://www.talairach.org/)
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## PROGRAM

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<td>Dr. Anna Planas (IIBB-CSIC, IDIBAPS)</td>
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<td>Optical microscopy, basic histology, advanced techniques for immunohistochemistry and immunocytochemistry</td>
<td>Dr. Joan Serratosa (IIBB-CSIC, IDIBAPS)</td>
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<td>Confocal microscopy and microscopic analysis of living cells</td>
<td>Dr. Maria Calvo (Serveis Cientifico-Tècnics UB)</td>
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<td>Presentation of new confocal microscopy technologies</td>
<td>Dr. Juan L Monteaguduo (LEICA MICROSYSTEMS)</td>
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<td>Flow Cytometry: technical description and applications</td>
<td>Dr. Neus Villamor (Hospital Clinic, IDIBAPS), Dr. Gemma Coma (BECTON-DICKINSON) Dr. Francesc Miró (IDIBAPS)</td>
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<td>Electronic microscopy techniques</td>
<td>Josep Rebled (Cryo-Electron Microscopy Unit of CCIT-UB Centres Científics i Tecnològics UB)</td>
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<td>Magnetic Resonance Imaging</td>
<td>Dr. Alberto Prats (Facultat Medicina, UB)</td>
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<td>Diffusion Tensor Imaging and Tractography</td>
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<td>In vivo imaging technology: positron emission tomography (PET)</td>
<td>Dr. José Dieguez Gisbert (SIEMENS)</td>
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<td>Autoradiography</td>
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<td>Dr. Santi Rojas (Fundació Pasqual Maragall)</td>
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<td>Microscopy image processing, optimization, and quantification.</td>
<td>Francisco Núñez (OLYMPUS)</td>
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<td>Analysis of in vivo images</td>
<td>Dr. Deborah Pareto (Hospital de la Vall d’Hebrón)</td>
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<td>Intravital microscopy</td>
<td>Dr. Azucena Salas (IDIBAPS)</td>
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<td>Imaging through bioluminiscence</td>
<td>Dr Jerónimo Blanco (CID, CSIC)</td>
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<td>Optical imaging in living animals and humans: Laser Technology</td>
<td>Dr. Turgut Durduran (ICFO)</td>
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